

WHAT IS CLAIMED IS:

1. A directional ground relay configured to receive a plurality of electric values relating to voltage and current from a three-phase electric power transmission line to be protected, the directional ground relay being configured to decide a direction of a fault in the power transmission line based upon the plurality of electric values, the directional ground relay comprising:

a zero-phase sequential current calculation unit configured to calculate a zero-phase sequential current based upon the current detected from the power transmission line; and

a phase-comparison unit configured to compare the phase of the zero-phase sequential current to the phase of any phase voltage, to decide whether the phase of the zero-phase sequential current is within a pre-determined range, and to output the phase of the voltage as a faulty phase of voltage in which a forward ground fault has occurred, when the phase of the zero-phase sequential current is within the pre-determined range.

2. The directional ground relay according to Claim 1, further comprising:

an absolute-value comparison unit configured to decide whether the zero-phase sequential current is

equal to or greater than a pre-determined value; and

a forward-fault decision unit configured to decide that a forward ground fault has occurred and to output the phase of the voltage as a faulty phase of voltage in which a forward ground fault has occurred, when the zero-phase sequential current is decided as within the pre-determined range by the phase-comparison unit, and when the zero-phase sequential current is decided as equal to or greater than a pre-determined value by the absolute-value comparison unit.

3. A directional ground relay system comprising:

a directional ground relay configured to calculate a zero-phase sequential current and a zero-phase sequential voltage based upon electric values relating to voltage and current detected from a three-phase electric power transmission line to be protected, the directional ground relay being configured to decide a direction of a ground fault in the power transmission line based upon a phase relation of the zero-phase sequential current and a zero-phase sequential voltage;

an sudden current-change relay configured to be activated when a phase current has changed at a rate more rapid than a pre-determined rate; and

a faulty phase decision unit configured to decide that a phase corresponding to the activated sudden

current-change relay is a phase in which the fault has occurred, when the ground fault is decided to be a forward fault by the directional ground relay.

4. A directional ground relay system comprising:

a first directional ground relay configured to receive a plurality of electric values relating to voltage and current from a three-phase electric power transmission line to be protected, the directional ground relay being configured to decide a direction of a fault in the power transmission line based upon the plurality of electric values, the directional ground relay comprising: a zero-phase sequential current calculation unit configured to calculate a zero-phase sequential current based upon the current detected from the power transmission line; and a phase-comparison unit configured to compare a phase of the zero-phase sequential current to a phase of voltage corresponding to the voltage in the power transmission line, to decide whether the zero-phase sequential current is within a pre-determined range, and to output the phase of the voltage as a faulty phase of voltage in which a forward ground fault has occurred, when the zero-phase sequential current is within the pre-determined range;

a second directional ground relay configured to calculate a zero-phase sequential current and a zero-

phase sequential voltage based upon electric values relating to voltage and current detected from the power transmission line, the directional ground relay being configured to decide a direction of a ground fault in the power transmission line based upon a phase relation of the zero-phase sequential current and a zero-phase sequential voltage; and

a faulty phase decision unit configured to decide that a phase in which the first ground directional relay is activated is a faulty phase, when the second directional ground relay decides a forward fault.

5. The directional ground relay system according to Claim 4, wherein the first directional ground relay further comprising:

an absolute-value comparison unit configured to decide whether the zero-phase sequential current is equal to or greater than a pre-determined value; and

a forward-fault decision unit configured to decide that a forward ground fault has occurred and to output the phase of the voltage as a faulty phase of voltage in which a forward ground fault has occurred, when the zero-phase sequential current is decided as within the pre-determined range by the phase-comparison unit, and when the zero-phase sequential current is decided as equal to or greater than a pre-determined value by the

absolute-value comparison unit.

6. A directional ground relay system comprising:

a directional ground relay configured to calculate a zero-phase sequential current and a zero-phase sequential voltage based upon electric values relating to voltage and current detected from a three-phase electric power transmission line to be protected, the directional ground relay being configured to decide a direction of a ground fault in the power transmission line based upon a phase relation of the zero-phase sequential current and a zero-phase sequential voltage;

a transmitter and a receiver configured to exchange signals between a local terminal and a remote terminal; and

an sudden current-change relay configured to be activated when a phase current has changed at a rate more rapid than a pre-determined rate;

wherein the system is configured to output a trip signal of a local terminal to the output phase of the sudden current-change relay and to transmit a permission signal to the remote terminal, if a permission signal is received from a relay of the remote terminal, and if the directional ground relay has not detected a reverse fault.

7. The directional ground relay system according to Claim 6, further comprising:

a reverse fault detection element of a distance relay configured to decide a fault direction based upon the electric values relating to voltage and current detected from the power transmission line,

wherein the system is configured to output the trip signal of the local terminal to the output phase of the sudden current-change relay and to transmit the permission signal to the remote terminal, if the permission signal is received from the relay of the remote terminal, and if neither the directional ground relay nor the reverse fault detection element of the distance relay has detected a reverse fault.